

Biochemistry of biological fluids (BIOCH 472)

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Class 9:

Sweat

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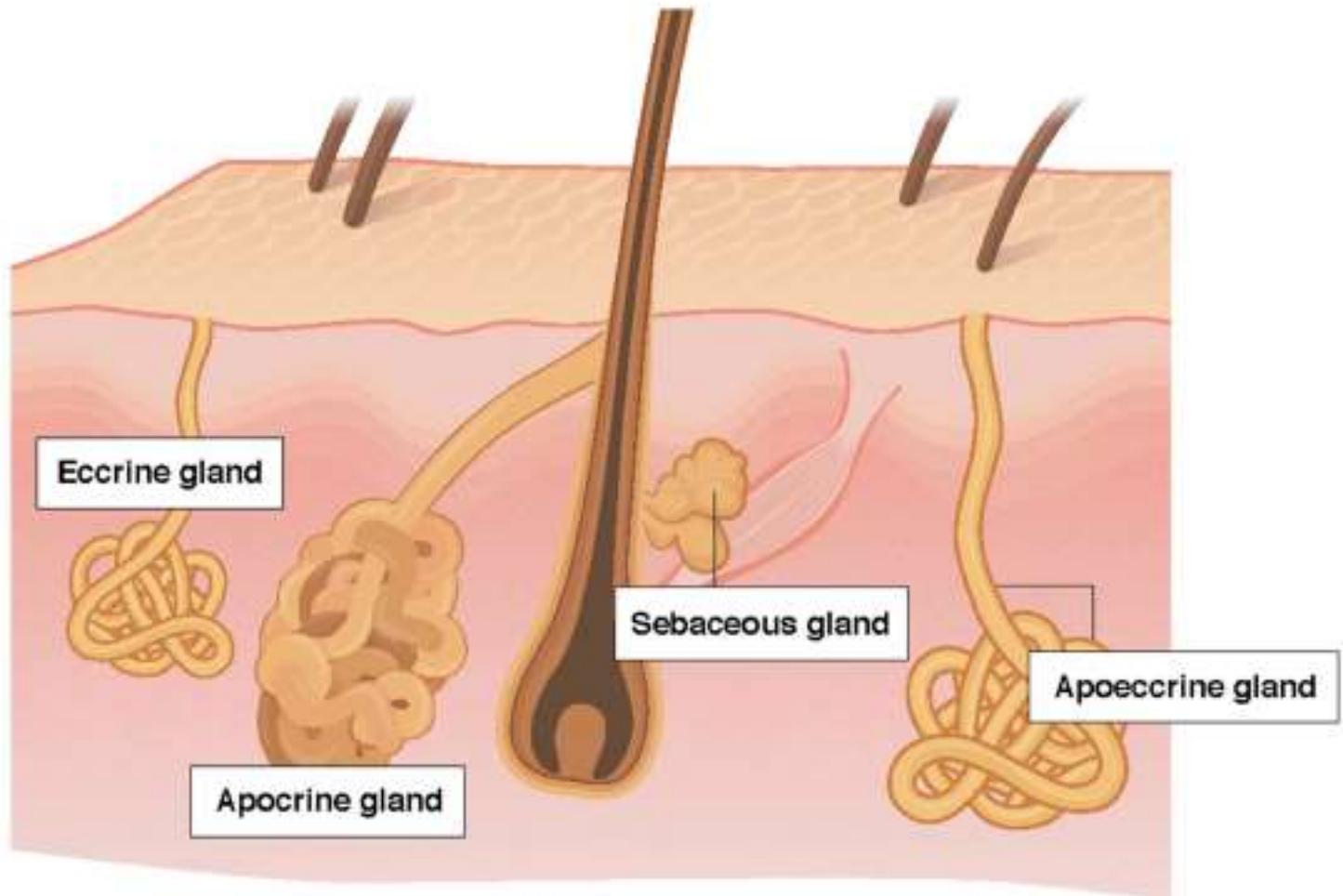
Objectives for this lecture

- Describe the formation and function of Sweat

Sweat Fluid

- plays a critical role in human **thermoregulation**.
- sweat glands are play an excretory function similar to renal system by clearing excess:
 - *Micronutrient (skin health, excess).*
 - *Metabolic waste.*
 - *Toxicants*
- Sweat excretion may lead to perturbations in health, such as *micronutrient imbalances*.

Types of sweat glands



Type of Sweat Glands

1. *Eccrine:*

- small, numerous, highest volume excretion.
- found on glabrous (palms, soles) and non-glabrous (hairy) skin.
- total **number is fixed** throughout life, gland density decreases with skin expansion during growth (high in children)
- Its sweat is water and NaCl.

2. *Apocrine:*

- In axilla, breasts, face, scalp, and the perineum.
- Larger, open into hair follicles instead of onto the skin surface.
- produce lipid-rich sweat, proteins, sugars, and ammonia.
- Its scent glands by producing pheromones (body odor).

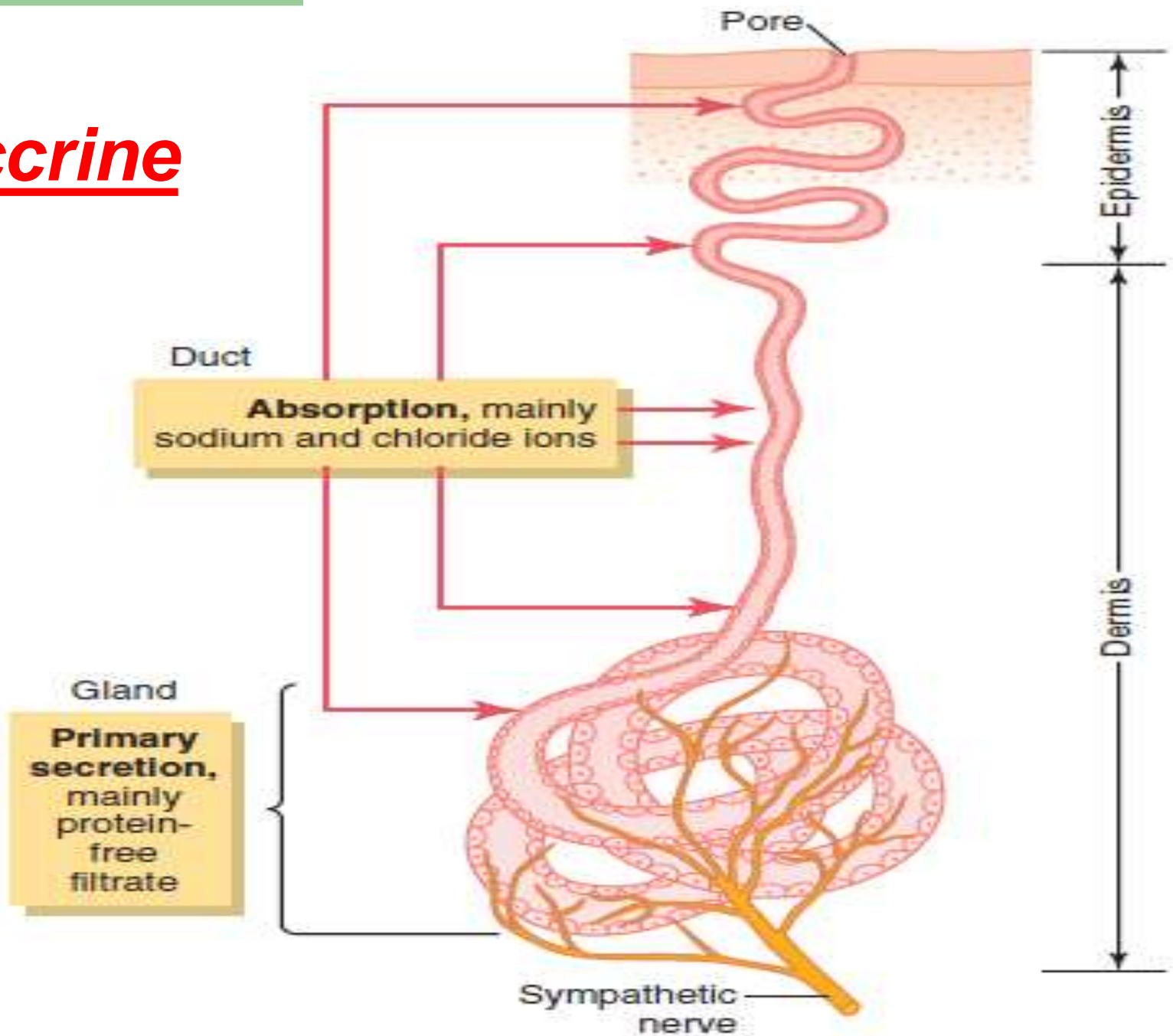
3. *Apoecrine:*

- develop from eccrine sweat glands between the ages of ~8 to 14 years (*axillary*).
- produces high salt water secretions.

4. *Sebaceous glands:*

- not a type of sweat gland.
- Associated with hair follicles, present in scalp, forehead, face, and anogenital area.
- Absent on the palms of hands and soles of the feet.
- Secrete triglycerides, wax esters, cholesterol, and cholesterol esters.

Eccrine



- Transport and reabsorption of Na is an active process.
- *Eccrine sweat glands respond to:*
 - ✓ increased body core temperature (exercise).
 - ✓ skin temperature.
 - ✓ increases in skin blood flow.
- thermoreceptors is processed by hypothalamus.
- Catecholamines for neural stimulation of sweating

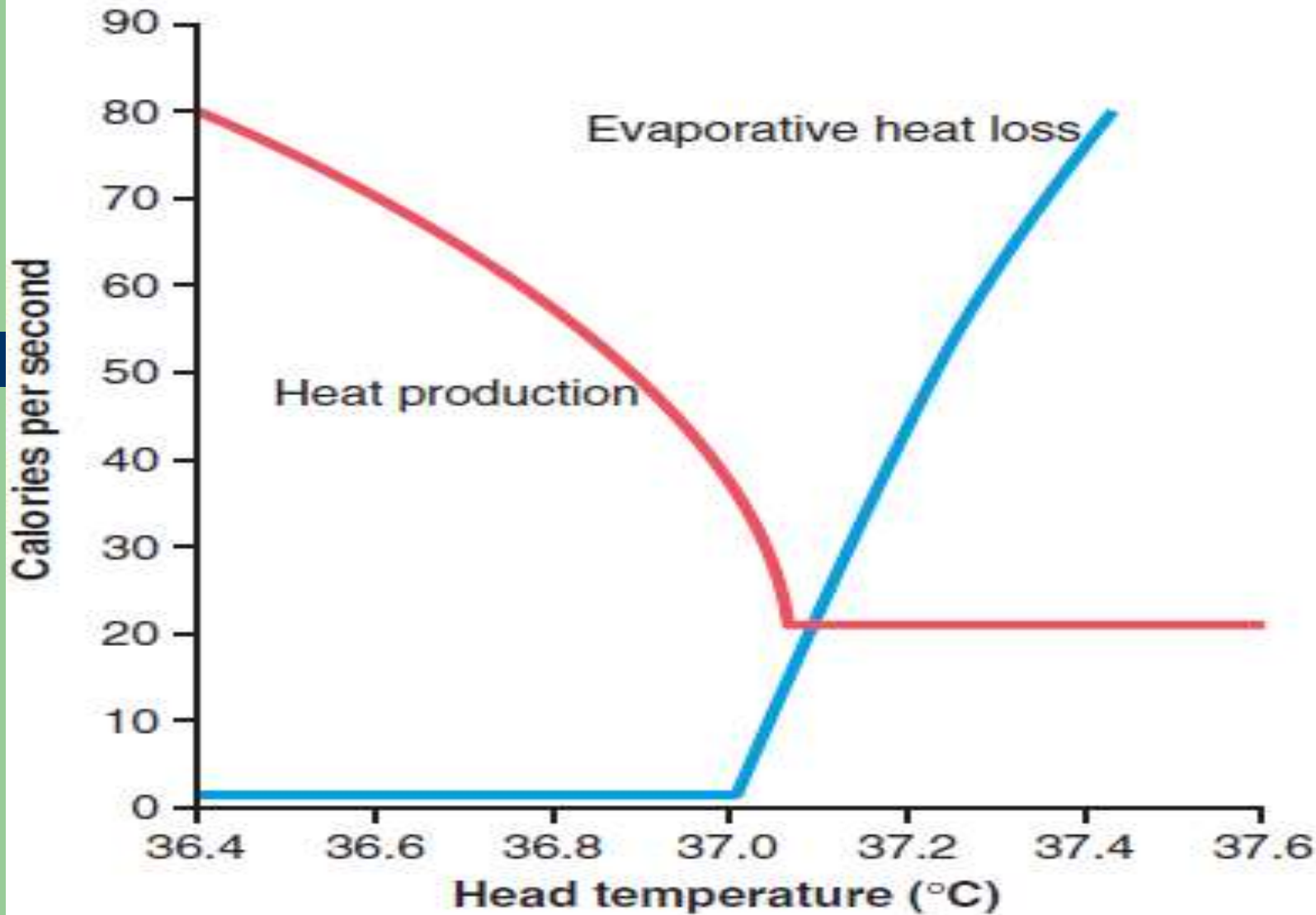


Figure 74-7. Effect of hypothalamic temperature on evaporative heat loss from the body and on heat production caused primarily by muscle activity and shivering. This figure demonstrates the extremely critical temperature level at which increased heat loss begins and heat production reaches a minimum stable level.

- **dehydration** delay the sweating response.
- **Hyperosmolality** increases body temperature threshold for sweating.
- **Hypovolemia** reduce sweating sensitivity.
- men exhibit higher sweating rates than women.

Lab Methodology

- Main aspects of sweat methodology:
 1. skin cleaning/preparation
 2. sweat stimulation
 3. sweat collection (*sweat and skin contaminant*)
 4. Sample storage
 5. analytical technique

sweat composition

❖ ***Micronutrients:***

- Water
- Electrolytes (Na, Cl, K, Ca)
- Trace element (Fe, Zn, Mg, Cu)
- Vitamins

❖ ***Non-Micronutrients:***

- Lactate
- Urea
- Ethanol
- Ammonia
- Bicarbonate
- Glucose
- Antibodies
- Proteins

Comparison of sweat gland and kidney function

- Na reabsorption in sweat gland is greater than that of the kidneys.
- Chemicals excreted in sweat have higher concentration than that of blood and/or urine.
- effective cure for hangovers after heavy drinking is to stimulate sweating (via exercise or sauna bathing).

- transport urea across sweat gland, especially in patients with kidney damage, to clear the blood of high urea concentrations.

sweat gland function from conditions

- Reduced sweating include burns and skin grafting sunburn, miliaria rubra, and atopic dermatitis.
- *Hyperhidrosis*, excess sweating, occur with:
 - ✓ primary etiology (fever, pregnancy, menopause).
 - ✓ pathology (malignancy, endocrine, metabolic, or psychiatric disorder).

Cystic fibrosis

- Sweat **biomarker** is the use of **sweat [Cl]** for the diagnosis of cystic fibrosis.
- Individuals with cystic fibrosis have **higher** sweat [Cl] because of a genetic absence of a functioning CFTR (two defective genes, homozygote).
- In cystic fibrosis the sweat [Cl] >60 mmol/L.
- Na is also poorly reabsorbed in individuals with cystic fibrosis, being high in sweat.

Reference

- Physiology of sweat gland function: The roles of sweating and sweat composition in human health, *Lindsay B. Baker*, 2332-8959 (*Online*)
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<https://www.tandfonline.com/loi/ktmp20>